

SmartLog V5™ Turnstile Installation, Operation and Maintenance



Made in the
United States of America



Figure 1. EMIT 50770 SmartLog V5™ Turnstile

Description

Use the EMIT SmartLog V5™ Turnstile to enforce ESD access control to your facility. The EMIT 50770 Turnstile is constructed of high quality stainless steel and includes a SmartLog V5™ with mounting fixture. The turnstile will activate when a user passes their required ESD test. Use the turnstile's integrated timer to set its unlock time to 5, 10, 15 or 20 seconds.

By touching the solid-state switch once, the SmartLog V5™ tests the resistance path limits of the worn wrist strap and both worn ESD footwear independently in less than 2 seconds. It may also test a worn ESD garment if it is used as part of personnel grounding path. Test results are electronically stored in the SmartLog V5™ and easily downloaded to a PC for logging records and evaluation. This product can be used as one of the tools to fulfill the ANSI/ESD S20.20 section 7.3 "Compliance Verification Plan."

See [TB-6578](#) for more information on the patented* EMIT SmartLog V5™.

*US Patents 6,078,875 and 6,809,522

ESD Association Information

"Compliance verification should be performed prior to each use (daily, shift change, etc.). The accumulation of insulative materials may increase the foot grounder system resistance. If foot grounders are worn outside the ESD protected area testing for functionality before reentry to the ESD protected area should be considered." ESD SP9.2 APPENDIX B - Foot Grounder Usage Guidance

"Process monitoring (measurements) shall be conducted in accordance with a Compliance Verification Plan that identifies the technical requirements to be verified, the measurements limits and the frequency at which those verifications shall occur...Compliance verification records shall be established and maintained to provide evidence of conformity to the technical requirements.

The test equipment selected shall be capable of making the measurements defined in the Compliance Verification Plan." (ANSI/ESD S20.20-2007) section 7.3

ANSI/ESD S20.20 Table 1 Flooring-Footwear Systems Technical Requirements Recommended Range "less than 3.5×10^7 ohms measured per ANSI/ESD STM 97.1."

"Typical test programs recommend that wrist straps that are used daily should be tested daily. However, if the products that are being produced are of such value that knowledge of a continuous, reliable ground is needed, and then continuous monitoring should be considered or even required." (ESD Handbook ESD TR 20.20 section 5.3.2.4.4)

Packaging

- 1 Turnstile, 120VAC
- 1 SmartLog V5™
- 1 Turnstile Mounting Bracket
- 1 Wall Mounting Bracket
- 1 Connection Cover
- 1 Dual Independent Foot Plate
- 1 Foot Plate Cable, 6'
- 1 Power Adapter, 12VDC 1.25A center pos.
- 1 DB9 Serial Adapter
- 1 Pan Head Screw, 4-40 thread
- 3 Pan Head Screws, 10-32 thread
- 3 Nuts, 10-32 thread
- 3 Washers
- 2 Wall Mounting Anchors
- 2 Wall Mounting Screws, #10 x 1-1/2"
- 8 Turnstile Keys
- 2 Zip Ties with Adhesive Pads
- 1 Certificate of Calibration

Installation

Installing the Turnstile

A 110VAC power line and Ethernet line are needed at the installation location of every SmartLog V5™ Turnstile. Be sure to route these lines to the installation site prior to anchoring your turnstile.

See the attached Alvarado EDC Installation and Maintenance Manual for instructions on anchoring and wiring the turnstile. Do not mount the SmartLog V5™ and its mounting bracket to the turnstile until it is properly anchored and wired.

Installing the SmartLog V5™ to the Turnstile

See [TB-6578](#) to learn more about the features and components of the SmartLog V5™. EMIT recommends making any adjustments to its clock or test configurations prior to installing it to the turnstile.

1. Disconnect the SmartLog V5 tester from the mounting bracket by removing the 4-40 pan head screw located on the left-hand side of the tester.
2. Open the turnstile's cover using the included keys. Set the power switch located on the power box to the ON position.
3. Install the mounting bracket onto the turnstile's cover using the three 10-32 screws, washers and nuts. From top to bottom, the installation order is: screw, washer, mounting bracket, turnstile cover, nut.
4. Route the SmartLog's foot plate cable, power adapter, ground cord, relay wires and Ethernet cable through the turnstile and bracket.

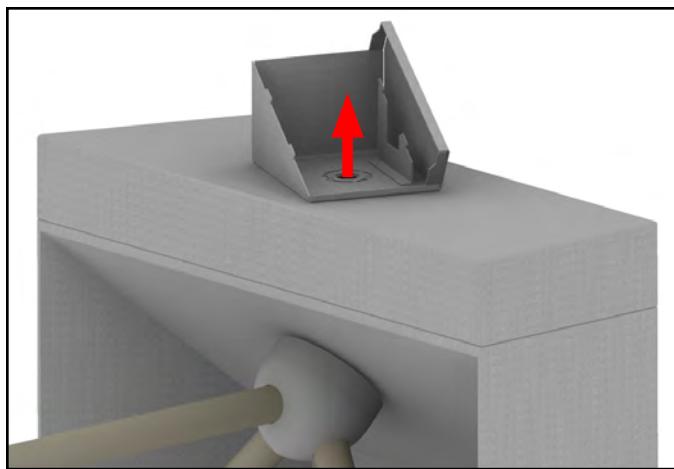


Figure 2. Routing the cords and cables through the turnstile's cover and bracket

5. Follow Figure 3 and connect all of the cables to the SmartLog V5™.

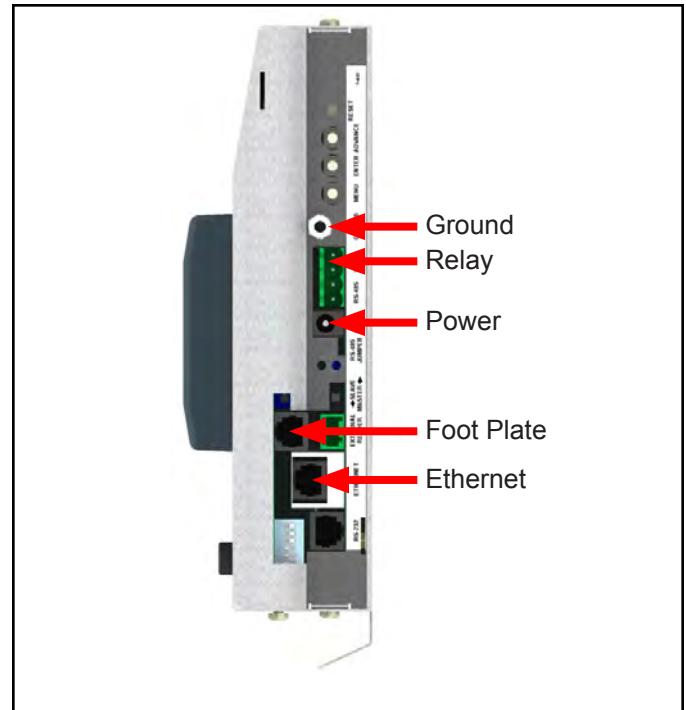


Figure 3. Connections to the SmartLog V5™ (right view, cover off)

6. Align the slots on the back of the SmartLog V5™ with the hooks on the turnstile bracket.

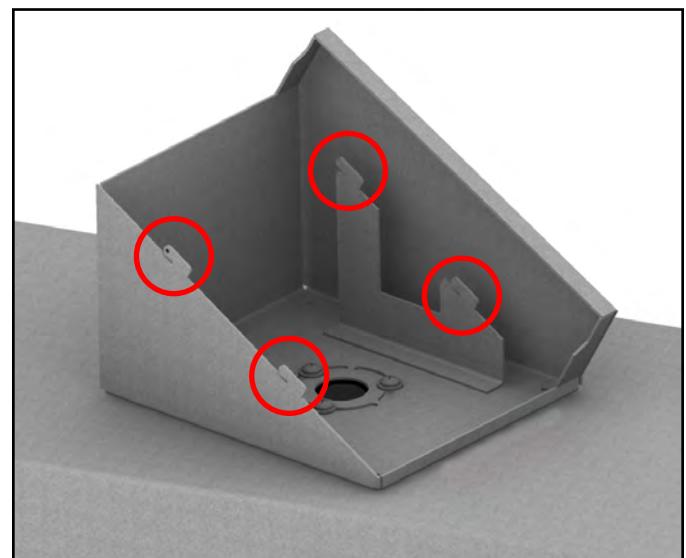


Figure 4. Locating the mounting hooks on the bracket

7. Slide the SmartLog V5™ into the bracket from top to bottom. Secure the SmartLog V5™ to the bracket by fastening the included 4-40 screw on the left-side of the tester.



Figure 5. Sliding the SmartLog V5™ into the bracket and securing it into place with the 4-40 screw

8. Locate the foot plate cable at the base of the turnstile and connect it to the Dual Independent Foot Plate. Place the foot plate at the base of the turnstile so operators can place their feet on it while performing tests at the turnstile's entrance.



Figure 6. Installing the Dual Independent Foot Plate

9. Complete the installation by establishing communication to the SmartLog V5™ via the Ethernet cable. See the "Ethernet Setup" procedure in [TB-6578](#) for more information.

Operation

NOTE: The SmartLog V5™ must first be programmed with the user ID table using the TEAM5 Software before being deployed for employee use, or the default test settings will be applied.

See the [TEAM5 User Manual](#) for more information.

1. Initiate the test procedure by identifying yourself to the SmartLog. This may be done using the keypad, barcode badge scanner or proximity badge reader (if supplied).
2. Follow the prompt on the SmartLog's display.
3. When performing a footwear test, be sure to place both feet on the dual foot plate (one foot per plate).

When performing a wrist strap test, be sure to completely plug in the wrist cord into the tester's jack.

4. Press and hold the metal touch plate on the tester to perform the test. Hold your finger on the touch plate until the results of the test are displayed.

If performing a wrist strap test, and the wrist strap status LEDs do not illuminate, verify that the wrist cord is correctly inserted into the tester.

5. The relay terminal will activate and unlock the turnstile if the defined tests are passed.
6. Pass through the turnstile. The turnstile will re-lock after one rotation.



NOTE: By default, the turnstile will remain unlocked until either the operator passes through or 20 seconds expire. See page 17 in the attached Alvarado EDC Installation and Maintenance Manual for instructions on modifying the turnstile's Timed Delay Reset Timer.

Calibration

Frequency of recalibration should be based on the critical nature of those ESD sensitive items handled and the risk of failure for the ESD protective equipment and materials. In general, EMIT recommends that calibration be performed annually.

Use the EMIT 50424 Limit Comparator to perform periodic testing (once every 6-12 months) of the SmartLog V5™. The Limit Comparator can be used on the shop floor within a few minutes virtually eliminating downtime, verifying that the tester is operating within tolerances.

See [TB-6581](#) for more information.



Specifications

SMARTLOG V5™ TURNSTILE

Operating Voltage	110 VAC, 60 Hz
Operating Temperature	32°F - 104°F (0 - 40°C)
Dimensions (Crated)	42" x 40" x 49" (107cm x 102cm x 124cm)
Dimensions (Uncrated)	See Figure 7
Weight (Crated)	385 lbs (175 kg)
Weight (Uncrated)	285 lbs (129 kg)

SMARTLOG V5™ TESTER

Operating Voltage	100-240 VAC, 50/60 Hz
Operating Temperature	32°F - 104°F (0 - 40°C)
Dimensions	8.3" x 5.8" x 1.9" (21.1cm x 14.7cm x 4.8cm)
Weight	2.0 lbs (0.9 kg)

DUAL INDEPENDENT FOOT PLATE

Dimensions	14.0" x 16.0" x 0.9" (35.6cm x 40.1cm x 2.3cm)
Weight	7.5 lbs (3.4 kg)

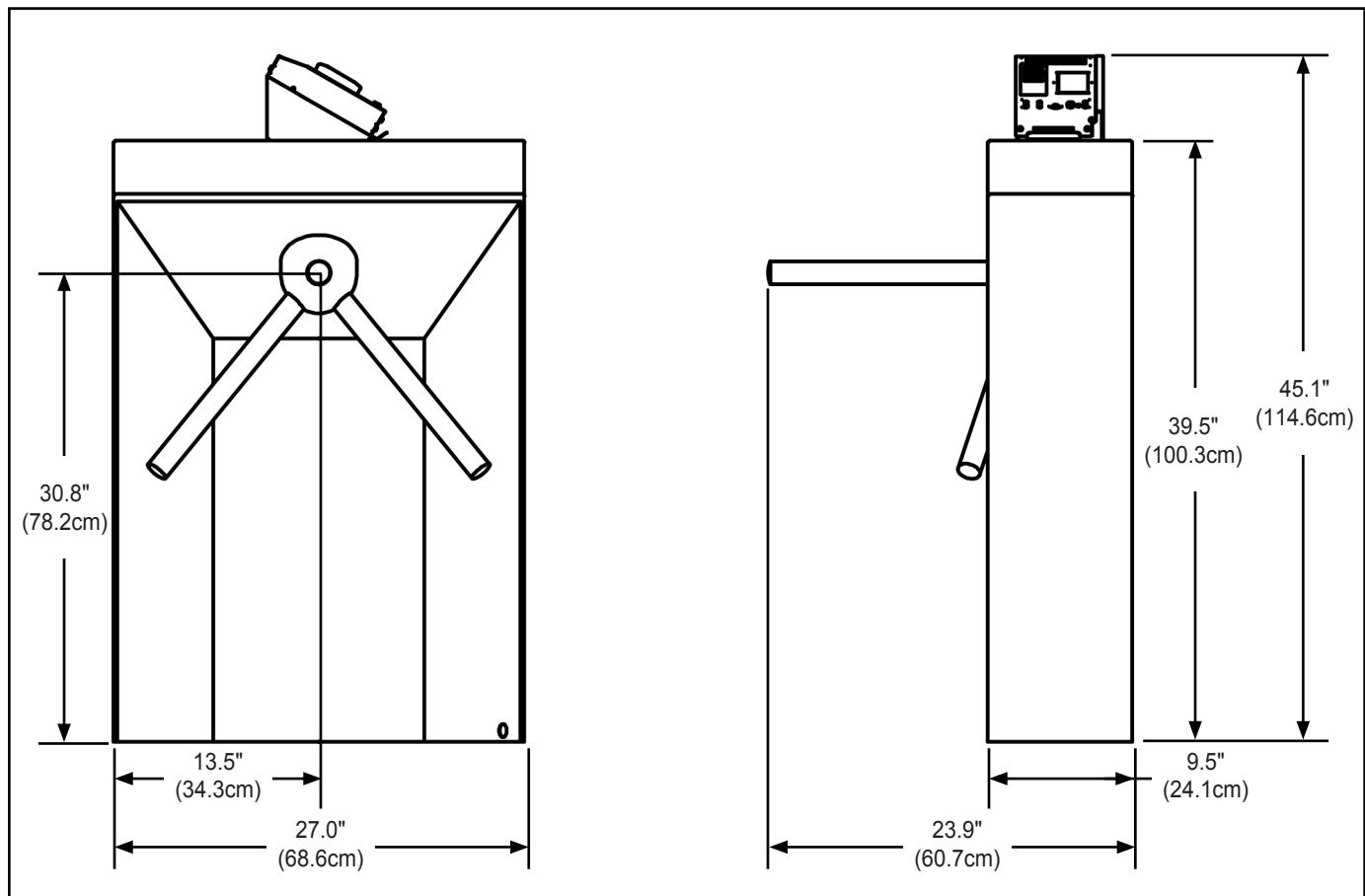


Figure 7. Dimensions of the EMIT 50770 SmartLog V5™ Turnstile

Limited Warranty

SMARTLOG V5™ TESTER

Limited Warranty

EMIT expressly warrants that for a period of five (5) years from the date of purchase EMIT SmartLog V5™'s will be free of defects in material (parts) and workmanship (labor). Within the warranty period, a credit for purchase of replacement EMIT products, or, at EMIT's option, the product will be repaired or replaced free of charge. If product credit is issued, the amount will be calculated by multiplying the unused portion of the expected five year life times the original unit purchase price. Call our Customer Service Department at 909-664-9980 (Chino, CA) for a Return Material Authorization (RMA) and proper shipping instructions and address. Please include a copy of your original packing slip, invoice, or other proof of date of purchase. Any unit under warranty should be shipped prepaid to the EMIT factory. Warranty replacements will take approximately two weeks.

If your unit is out of warranty, call our Customer Service Department at 909-664-9980 (Chino, CA) for a Return Material Authorization (RMA) and proper shipping instructions and address. EMIT will quote repair charges necessary to bring your unit up to factory standards.

Warranty Exclusions

THE FOREGOING EXPRESS WARRANTY IS MADE IN LIEU OF ALL OTHER PRODUCT WARRANTIES, EXPRESSED AND IMPLIED, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE WHICH ARE SPECIFICALLY DISCLAIMED. The express warranty will not apply to defects or damage due to accidents, neglect, misuse, alterations, operator error, or failure to properly maintain, clean or repair products.

Limit of Liability

In no event will EMIT or any seller be responsible or liable for any injury, loss or damage, direct or consequential, arising out of the use of or the inability to use the product. Before using, users shall determine the suitability of the product for their intended use, and users assume all risk and liability whatsoever in connection therewith.

TURNSTILE

Limited Warranty

EMIT expressly warrants that for a period of one (1) year from the date of purchase EMIT SmartLog V5™ Turnstiles will be free of defects in material (parts) and workmanship (labor). Within the warranty period, a credit for purchase of replacement EMIT turnstiles, or, at EMIT's option, the turnstile will be repaired or replaced free of charge. If product credit is issued, the amount will be calculated by multiplying the unused portion of the expected five year life times the original unit purchase price. Call our Customer Service Department at 909-664-9980 (Chino, CA) for a Return Material Authorization (RMA) and proper shipping instructions and address. Please include a copy of your original packing slip, invoice, or other proof of date of purchase. Any unit under warranty should be shipped prepaid to the EMIT factory. Warranty replacements will take approximately two weeks.

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INSTALLATION AND MAINTENANCE MANUAL



EDC / EDCX WAIST HIGH SECURITY TURNSTILE

This is the appropriate manual for EDC/EDCX turnstiles manufactured on or after October 1, 2010.

Turnstile Serial Number: _____

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EDC/EDCX PUD1535R4-0

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IMPORTANT SAFETY PRECAUTIONS

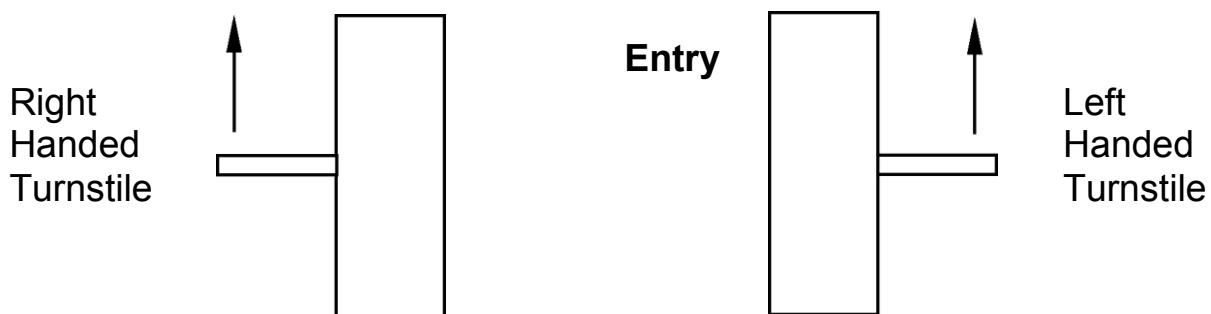
- Read this manual in its entirety before installing or operating the turnstile. If there are questions, you may contact Alvarado at (909) 591-8431, Monday through Friday, 6:00 AM to 4:30 PM PST.
- Use only skilled individuals to install and service the turnstile.
- The turnstile is not a toy. Do not allow children to play on or near the turnstile. Do not allow horseplay near the turnstile.
- Follow a proper maintenance schedule using skilled individuals.
- Do not operate the turnstile if it has been damaged in any manner. Have the turnstile repaired or adjusted by a skilled service person before use.
- Do not modify or alter the turnstile.
- Do not operate the turnstile unless the hydraulic damping unit is operating and adjusted correctly. For information on maintaining and adjusting the hydraulic damping unit please refer to item #5 of the Maintenance section on Page 19.
- Do not use non-Alvarado parts to repair the turnstile.
- For access control applications, train all personnel that will be using the turnstile in the proper method of operation. Ensure that new users are properly trained as well.

SAVE THESE PRECAUTIONS

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TURNSTILE CONFIGURATION DESCRIPTIONS



TURNSTILE CONFIGURATION

EDC-4X

Electrically controlled in one direction. Locked in opposite direction.

EDC-6X

Electrically controlled in both directions.

OTHER CONFIGURATIONS DESCRIBED IN DRAWINGS

Fail Lock

Turnstile locks when power is removed (or lost). Turnstile will unlock only when both power and an activation contact are supplied. This is how the turnstile leaves the factory unless specified otherwise.

Fail Safe

Turnstile unlocks in the event of power loss. Turnstile will relock when power is supplied.

Activation

Alvarado's turnstile requires a momentary dry contact of 25 ms or greater. The turnstile will not buffer activations. Once activated, the turnstile will not accept another activation until either the turnstile arm has been rotated or the time limit set has expired (if the adjustable timed delay automatic relock feature is enabled).

Lock / Unlock Override

This option overrides the access control system allowing one or both directions of passage to be locked or unlocked with a key. Locks may be located remotely or locally. Local locks are generally located near the arms on the cabinet fascia. When both directions have key overrides, the locks are keyed alike.

Adjustable Timed Delay

An activation signal unlocks the turnstile for one entry. Once the turnstile is unlocked, the user is allowed a set amount of time to pass through the turnstile.

If the turnstile arm is not rotated within the time frame allowed, the turnstile will automatically relock.

The duration of time allowed before the unit automatically relocks can be adjusted or disabled in the field. Adjustments can be made for each electrically controlled direction.

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OVERVIEW OF INSTALLATION / SLAB REQUIREMENTS

SLAB REQUIREMENTS

**MINIMUM THICKNESS: 4" LEVEL SOLID CONCRETE
DO NOT INSTALL ON ASPHALT**

OVERVIEW OF INSTALLATION STEPS:

- A. Determine turnstile locations taking into account power and activation wiring
- B. Anchor turnstile
- C. Connect Power
- D. Connect Activation Wiring

PARTS REQUIRED (SUPPLIED BY ALVARADO)

- 2 each All Thread Rods
- 2 each Cups
- 2 each Anchors

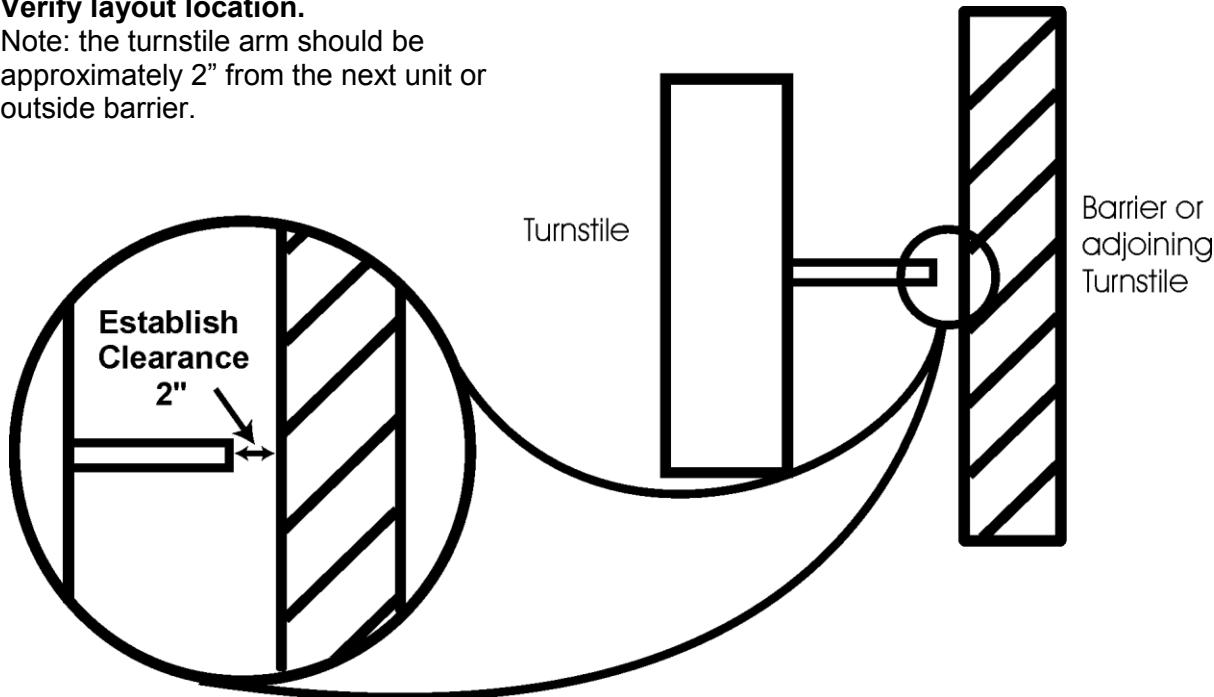
TOOLS REQUIRED:

- Heavy Duty Drill or Roto Hammer
- 1" Concrete Drill Bit
- Ratchet with 15/16" Socket Torque Wrench
- 1/8" Allen Wrench
- Hammer
- Shop Vac
- Tape Measure
- Chalk
- Shim Material
- Safety Glasses

TURNSTILE LOCATION AND BARRIER SPACING

Verify layout location.

Note: the turnstile arm should be approximately 2" from the next unit or outside barrier.



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INSTALLATION

INSTALLING THE TURNSTILE

1. Open the turnstile lid.
2. Place the turnstile in the desired location.
3. Remove the transformer/power switch box so that both welded post anchor tubes are accessible. (Refer to the photos on the following page for the mounting screw locations).
4. Mark the center location of the two anchors (See Drawing #1 on the following page). Do this by chalking the bottom of one of the all-thread shaft rods and running the rod through each of the post anchor tubes welded to the inside of the cabinet. Tap the rod gently to mark the concrete for drilling.

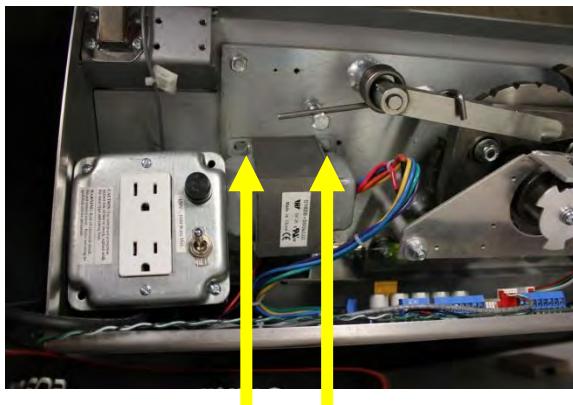
NOTE: There are four types of EDC cabinets (Standard, Extended, Bullnose, and Extended Bullnose). The EDC anchoring footprint is the same, regardless of the cabinet type. METAL TEMPLATES may be purchased from Alvarado, which simplifies this process.
5. Move the turnstile and drill a 1" diameter hole at the center of each marked location. Drill each hole 3" deep (See Drawing #3 on the following page). For Terrazzo, ceramic tile, or brick veneer installations add the thickness of the finished floor material to the anchor hole depth.
6. Vacuum out holes thoroughly. If the holes are not clean, the anchors will not tighten.
7. Insert an anchor into each drilled hole. Ensure that the anchors are flush with the concrete floor. NOTE: Insert anchors with threads down.
8. Return the turnstile to the install location.
9. Place a cup on each threaded shaft rod. Run the cup to the top of the rod (See Drawing #2 on the following page).
10. Run a threaded rod & cup assembly through one of the welded post anchor tubes seating the rod into the anchor previously inserted into the drilled hole.
11. Repeat this process with the other threaded rod & cup assembly.
12. If the turnstile is uneven or rocks, shim the turnstile cabinet as necessary.
13. Tighten both threaded shaft rods. Torque to approximately 40 ft.-lbs. initially and check the turnstile cabinet for any instability or rocking. If the turnstile is still uneven or rocks, back off the threaded rods and shim the turnstile cabinet as necessary.
14. Once the turnstile is firmly situated, torque the threaded shaft rods to 80 ft-lbs.
15. Remount the transformer/power switch box to the turnstile chassis.

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TURNSTILE INSTALLATION REFERENCE PICTURES AND DRAWINGS

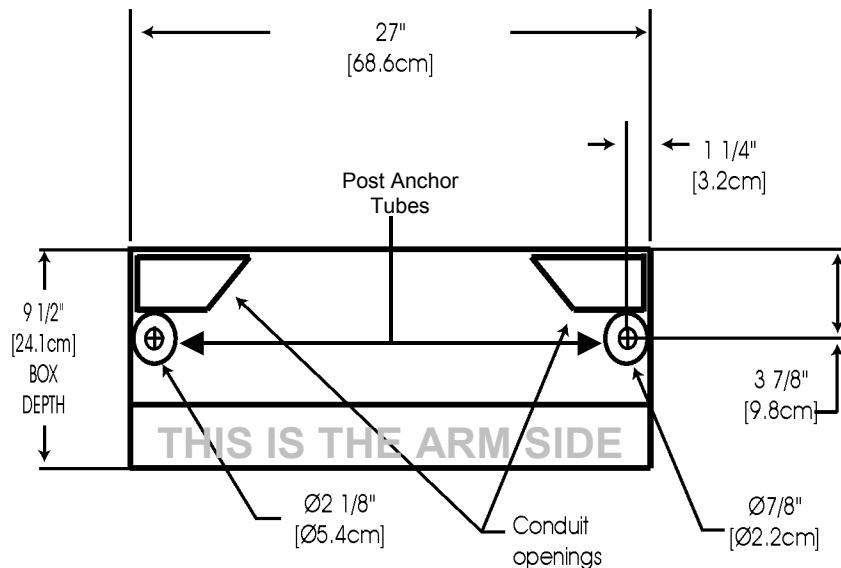


Remove the screws as shown to access the obstructed welded post anchor tube.



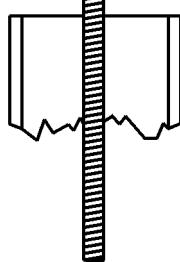
After removing the mounting screws, carefully move the transformer/power switch box to the side and continue installing the turnstile.

(Drawing #1)

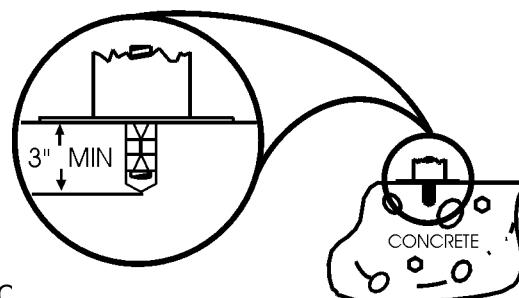


(Drawing #3)

(Drawing #2)



Placement of threaded rod and cup.



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ELECTRICAL AND ACTIVATION WIRING INSTRUCTIONS

TOOLS REQUIRED: Wire Stripper

PARTS REQUIRED: Wire Nuts

INSTRUCTIONS:

(NOTE: USE ONLY SKILLED ELECTRICIANS TO CONNECT POWER)

1. Make sure that primary power to the unit is off.
2. Locate the wiring diagram for the turnstile model being installed. The model number is listed on the manufacturer's serial number plate mounted near the head on the cabinet fascia. (e.g. EDC-4X-R, EDC-4X-R-FS)
3. Unlock and open lid.
4. Connect 110 VAC to the transformer/power switch box.
5. Connect the access control system activation leads to the board.
6. Review all electrical wiring and contacts for exposure to any metal parts that may lead to a short.
7. Manually rotate the turnstile and inspect the optical sensors for proper alignment and free rotation of the sensor feedback disk.
8. Turn ON the primary power to the unit. For both fail-lock and fail-safe units the turnstile should be locked in the controlled direction(s) when power is applied.
9. Turn the primary power OFF again. If the unit is fail-lock, confirm that the turnstile remains locked upon loss of power. If the unit is fail-safe, confirm that the turnstile unlocks upon loss of power.
10. Turn the primary power ON again.

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WIRING INSTRUCTIONS continued...

11. Locate the Entry Activation Test Button(s) on the controller board inside the turnstile cabinet. (For help locating the test buttons, please refer to the appropriate wiring diagram provided with this manual. The test buttons are labeled SW6 and SW7 on the wiring diagrams.)

- The SW6 Entry Activation Test Button is used to test the Clockwise (CW) controlled direction
(This is also known as the Right-Hand (RH) direction).
- The SW7 Entry Activation Test Button is used to test the Counter Clockwise (CCW) controlled direction
(This is also known as the Left Hand (LH) direction).

NOTE: CCW and CW rotation is determined by viewing the rotation of the turnstile cam from above while the turnstile lid is open.

12. Push the appropriate Entry Activation Test Button. If the turnstile is functioning correctly the solenoid will “fire” and the turnstile will unlock.

13. Rotate the turnstile arm in the appropriate direction. If the turnstile is functioning correctly the turnstile will automatically relock.

14. Push the Entry Activation Test Button again. Observe that the turnstile unlocks, but DO NOT rotate the turnstile arm.

15. Wait for approximately 20 seconds. If the turnstile is functioning correctly the unit will “time out” and automatically relock after 20 seconds.

- The controller board provides four different “time out” timer settings. The available timer settings are 5, 10, 15, or 20 seconds. The timer settings are set using terminals T3 and T4 of SW4 on the controller board.

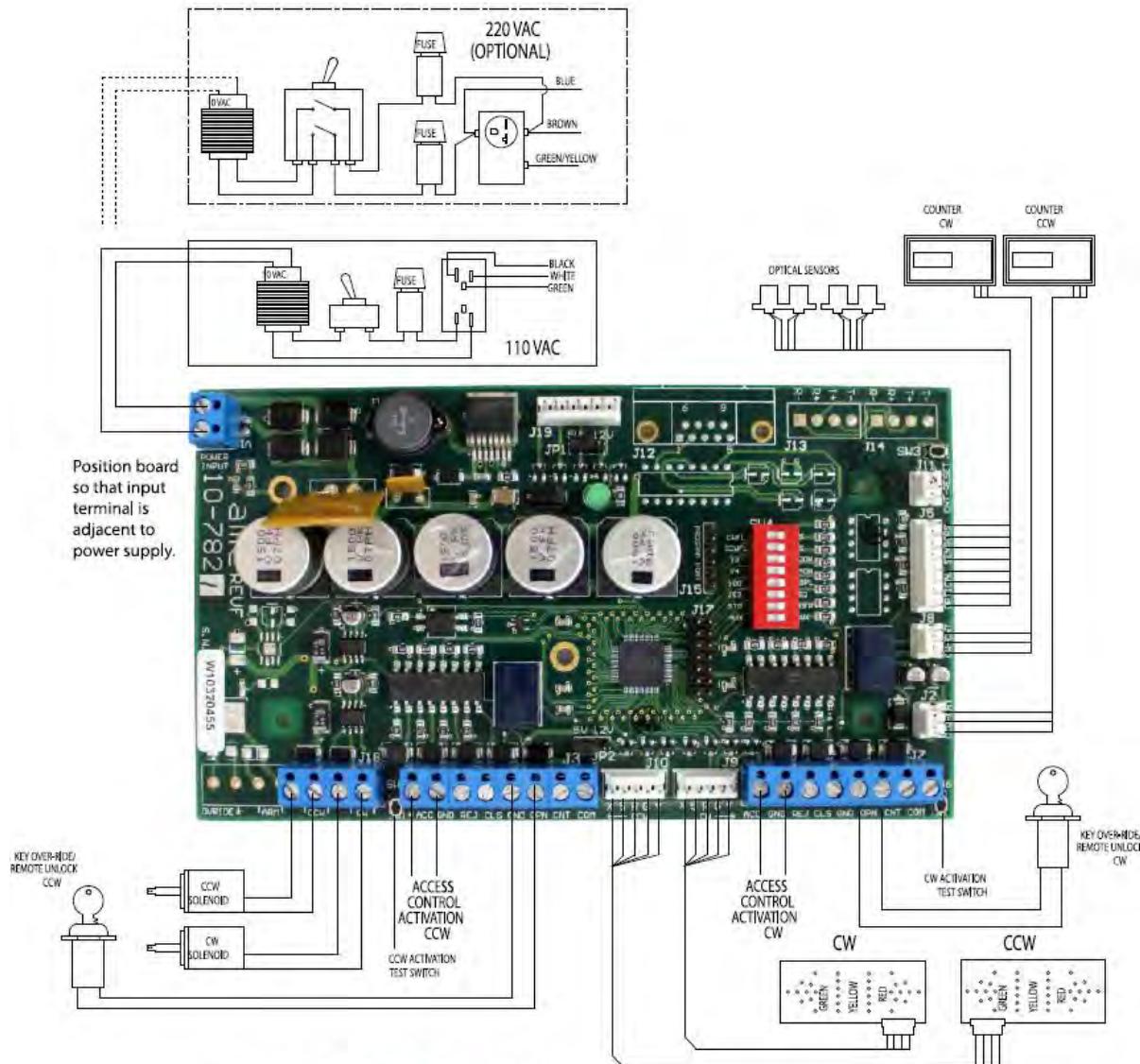
NOTE: Always test the turnstile after making adjustments to the timed delay feature. If the adjusted time duration is too short, the unit will relock too quickly and users will not be able to enter through the turnstile.

16. For bi-directionally controlled turnstiles (Model EDC-6X units ONLY) repeat steps 12 through 15 for the exit direction and confirm correct functionality.

17. Close the turnstile lid and lock.

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Primary Power Wire Connection for 110 and 220 Options 10-7821 ATC Rev. F (12V) Wiring Schematic



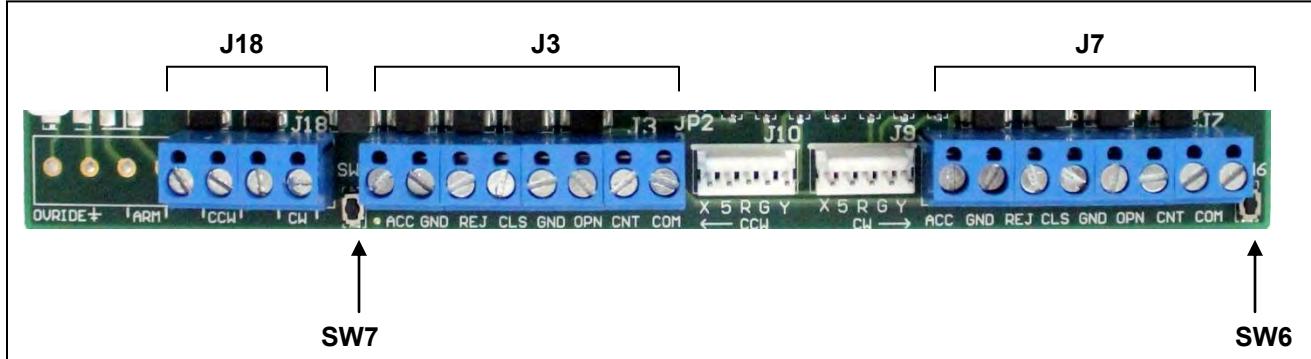
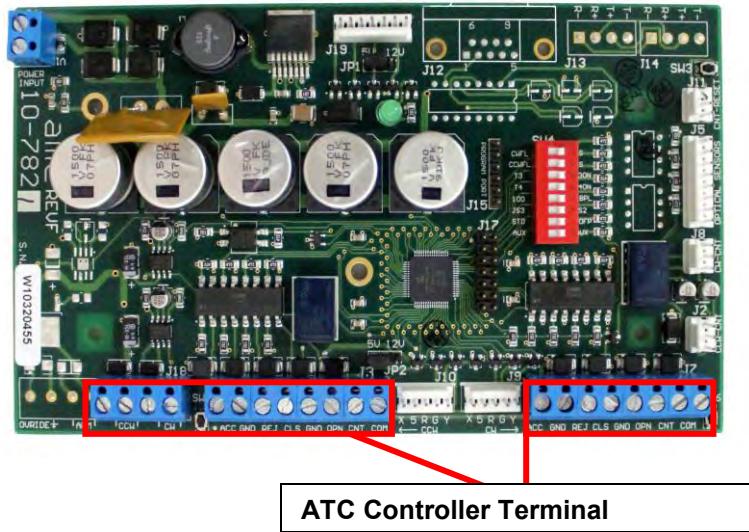
SW4 Switch Settings

SL14	
CWFL	FS
CCFL	FS
T3	T3ON
T4	T4ON
100	FBPL
JS3	JS2
STD	ROFP
AUX	AUX

TIMED DELAY RESET TIMER (Positions T3 and T4)		Switch	Setting
5 seconds		T3	ON
		T4	ON
10 seconds		T3	ON
		T4	OFF
15 seconds		T3	OFF
		T4	ON
20 seconds (Default Setting)		T3	OFF
		T4	OFF

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ATC Controller Terminal Descriptions



Board Location	Name	Description	Explanation
J18	CCW	Solenoid VDC wire connection - Left Hand/Counter Clockwise Direction	Connection for Counter Clockwise Solenoid. Universal polarity.
J18	CCW	Solenoid VDC wire connection - Left Hand/Counter Clockwise Direction	Connection for Counter Clockwise Solenoid. Universal polarity.
J18	CW	Solenoid VDC wire connection - Right Hand/ Clockwise Direction	Connection for Clockwise Solenoid. Universal polarity.
J18	CW	Solenoid VDC wire connection - Right Hand/ Clockwise Direction	Connection for Clockwise Solenoid. Universal polarity.
SW7	LH/CCW Entry Activation Test Button	Allows user to test turnstile activation - Left Hand/Counter Clockwise Direction	Depressing button simulates input to Location ACC, "Entry Accept". If turnstile solenoid "fires" after depressing button AND relocks after a single rotation of the turnstile arm OR upon time out, the turnstile is functioning correctly in the Left Hand/Counter Clockwise Direction.

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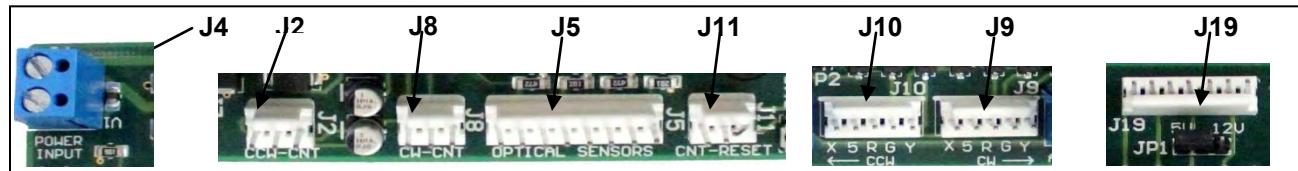
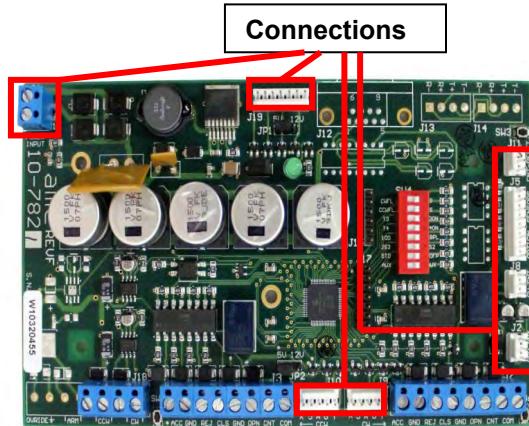
Board Location	Name	Description	Explanation
J3	ACC Entry Accept	“Card Authorized” input connection from the access control system - Left Hand/Counter Clockwise Direction	This connection is used to tell the turnstile to unlock. The ATC will accept a N/O dry contact signal of .25ms or longer from the access control system and allows one turnstile rotation before relocking.
J3	GND Ground	Ground wire connection from the access control system for ACC/REJ - Left Hand/Counter Clockwise Direction	Ground wire connection position for Entry Activation and Card Reject contact signal.
J3	REJ Entry Reject	“Card Unauthorized” input connection from the access control system - Left Hand/Counter Clockwise Direction	This connection is used to tell the turnstile to remain locked. The access control system has determined that the card presented is unauthorized for entry.
J3	CLS Close Passage	Connection for placing turnstile in always locked “CLOSED” configuration - Left Hand/Counter Clockwise Direction	Providing a continuous dry contact at this terminal places the turnstile in a locked “CLOSED” mode. This mode overrides the access control system operation. If a red entry light is installed (Location J10) it also will be illuminated continuously. Note: this connection is shown using a key switch in the schematic.
J3	GND Ground	Ground wire connection for “OPEN/CLOSE” Lane control - Left Hand/Counter Clockwise Direction	Ground wire connection for “OPEN/CLOSE” passage control.
J3	OPN Open Passage	Connection for placing turnstile in always unlocked “OPEN” configuration - Left Hand/Counter Clockwise Direction	Providing a continuous dry contact at this terminal places the turnstile in an unlocked “OPEN” mode. This mode overrides the access control system operation. If a green entry light is installed (Location J10), it will be illuminated green continuously. Note: this connection is shown using a key switch in the schematic.
J3	CNT Passage Count	Entry confirmation signal upon turnstile rotation - Left Hand/Counter Clockwise Direction	Outputs a dry contact upon rotation of the turnstile. This feature can be used to output a “count” signal to an external system such as Alvarado’s GateWatch or to provide feedback to the access control system that a turnstile rotation has taken place.
J3	COM Passage Count	Entry confirmation signal upon turnstile rotation - Left Hand/Counter Clockwise Direction	Common dry contact connection for CNT count signal output. See J3 CNT description.
J7	ACC Entry Accept	“Card Authorized” input connection from the access control system - Right Hand/Clockwise Direction	This connection is used to tell the turnstile to unlock. The ATC will accept a N/O dry contact signal of .25ms or longer from the access control system and allows one turnstile rotation before relocking.
J7	GND Ground	Ground wire connection from the access control system for ACC/REJ - Left Hand/Counter Clockwise Direction	Ground wire connection position for Entry Activation and Card Reject contact signal.
J7	REJ	“Card Unauthorized” input	This connection is used to tell the turnstile to

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Board Location	Name	Description	Explanation
	Entry Reject	connection from the access control system - Right Hand/Clockwise Direction	remain locked. The access control system has determined that the card presented is unauthorized for entry.
J7	CLS Close Passage	Connection for placing turnstile in always locked "CLOSED" configuration - Right Hand/Clockwise Direction	Providing a continuous dry contact at this terminal places the turnstile in a locked "CLOSED" mode. This mode overrides the access control system operation. If a red entry light is installed (Location J10) it also will be illuminated continuously. Note: this connection is shown using a key switch in the schematic.
J7	GND Ground	Ground wire connection for "OPEN/CLOSE" Lane control - Right Hand/Clockwise Direction	Ground wire connection for "OPEN/CLOSE" passage control.
J7	OPN Open Passage	Connection for placing turnstile in always unlocked "OPEN" configuration - Right Hand/Clockwise Direction	Providing a continuous dry contact at this terminal places the turnstile in an unlocked "OPEN" mode. This mode overrides the access control system operation. If a green entry light is installed (Location J10), it will be illuminated green continuously. Note: this connection is shown using a key switch in the schematic.
J7	CNT Passage Count	Entry confirmation signal upon turnstile rotation - Right Hand/Clockwise Direction	Outputs a dry contact upon rotation of the turnstile. This feature can be used to output a "count" signal to an external system such as Alvarado's GateWatch or to provide feedback to the access control system that a turnstile rotation has taken place.
J7	COM Passage Count	Entry confirmation signal upon turnstile rotation - Right Hand/Clockwise Direction	Common dry contact connection for CNT count signal output. See J3 CNT description.
SW6	RH/CW Entry Activation Test Button	Allows user to test turnstile activation - Right Hand/Clockwise Direction	Depressing button simulates input to Location ACC, "Entry Accept". If turnstile solenoid "fires" after depressing button AND relocks after a single rotation of the turnstile arm OR upon time out, the turnstile is functioning correctly in the Right Hand/Clockwise Direction.

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Connections

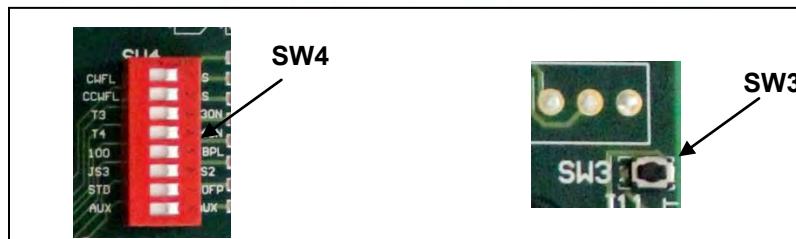
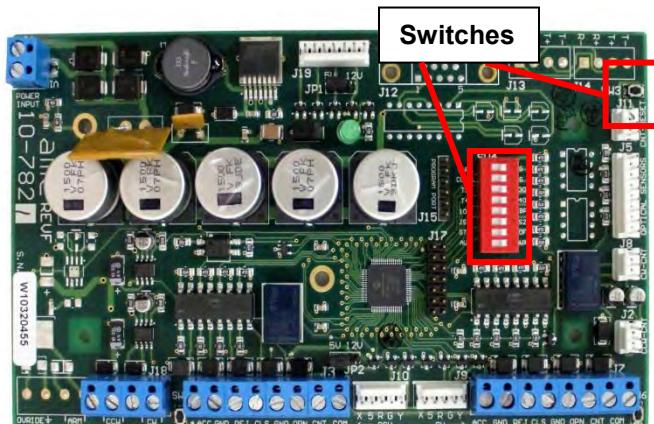


Board Location	Name	Description	Explanation
J2	CCW-CNT	Output of contact closure upon turnstile rotation – Left hand / Counter Clockwise Direction	Single throw, relay output for connection to Alvarado battery powered, digital counter.
J4	Power Input	Connection for low voltage power	The ATC will accept 10 VAC or 13.5 VDC power. If primary power is not run to the turnstile, low voltage power is connected here and the green ground wire must be grounded to the chassis.
J5	Optical Sensors	Connection for sensors	The ATC uses input from the sensors to provide rotation control functionality.
J8	CW-CNT	Output of contact closure upon turnstile rotation - Right Hand / Clockwise Direction	Single throw, relay output for connection to Alvarado battery powered, digital counter.
J9	X5RGY	Connection for Entry Lights - Left Hand/Counter Clockwise Direction	OPTIONAL: Support for 5 and 12 VDC LED lights. Use jumper JP2 to set voltage. If a red / green light board is used, the red light will be lit when the turnstile is powered and ready for card presentation. When a contact is provided to "Entry Accept" (Location ACC), the green light illuminates. The green light stays on for time out setting, or until the turnstile is rotated.
J10	X5RGY	Connection for Entry Lights - Right Hand/ Clockwise Direction	OPTIONAL: Support for 5 and 12 VDC LED lights. Use jumper JP2 to set voltage. If red /green light board is used, the red light will be lit when the turnstile is powered and ready for card presentation. When a contact is provided to "Entry Accept" (Location ACC), the green light illuminates. The green light stays on for time out setting, or until the turnstile is rotated.
J11	CNT-RESET	Connection for counter reset switch	N/O contact connection if blue counter wires are attached to J2 and/or J8 connections. A 3 position electrical key switch is connected here to provide a reset to the individuals counters.

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J19		Connection for EL function light board	OPTIONAL: Support for 5 and 12 VDC LED lights. Use jumper JP1 to set voltage. If red/green end light boards are used, the green light signifies that the turnstile is ready to accept an activation for the direction shown. When the CLS and GND connection is closed, the red light will be illuminated and signifies that the turnstile will not accept an activation. Refer to description for CLS on J3 and J7.
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Switches



Board Location	Name	Description	Explanation
SW3	Reset counters	Local Battery Counter Reset Switch	If blue counter wires are attached to the board, depressing this button will reset the counters. If two counters are installed and wired, both counters will be reset.
SW6	RH/CW Entry Activation Test Button	Allows user to test turnstile activation - Right Hand/Clockwise Direction	Depressing button simulates input to Location ACC, "Entry Accept". If turnstile solenoid "fires" after depressing button AND relocks after a single rotation of the turnstile arm OR upon time out, the turnstile is functioning correctly in the Right Hand/Clockwise Direction.
SW7	LH/CCW Entry Activation Test Button	Allows user to test turnstile activation - Left Hand/Counter Clockwise Direction	Depressing button simulates input to Location ACC, "Entry Accept". If turnstile solenoid "fires" after depressing button AND relocks after a single rotation of the turnstile arm OR upon time out, the turnstile is functioning correctly in the Left Hand/Counter Clockwise Direction.



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SW4 Switch Settings

Explanation of switch positioned to left or OFF side	Switch Position	Switch Position	Explanation of switch positioned to right or ON side
Sets solenoid control for the Clockwise direction in fail lock configuration. Power is applied to solenoid upon activation signal to release lock arm for rotation.	CWFL	FS	Sets solenoid control for the Clockwise direction in fail safe configuration. Power is applied to solenoid for locked condition and removed upon activation signal to release lock arm for rotation.
Sets solenoid control for the Counter Clockwise direction in fail lock configuration. Power is applied to solenoid upon activation signal to release lock arm for rotation.	CCWFL	FS	Sets solenoid control for the Counter Clockwise direction in fail safe configuration. Power is applied to solenoid for locked condition and removed upon activation signal to release lock arm for rotation.
Adjustment control of the maximum throughput time allowed for an individual to completely travel through the turnstile before the turnstile automatically relocks. Used with switch position T4. Always test operation after adjusting to ensure that the set time allowed is compatible with the functionality required for the turnstile. Refer to the Entry Time Adjusting Control Switch Settings table below. (Default)	T3	T3ON	Adjustment control of the maximum throughput time allowed for an individual to completely travel through the turnstile before the turnstile automatically relocks. Used with switch position T4. Always test operation after adjusting to ensure that the set time allowed is compatible with the functionality required for the turnstile. Refer to the Entry Time Adjusting Control Switch Settings table below.
Adjustment control of the maximum throughput time allowed for an individual to completely travel through the turnstile before the turnstile automatically relocks. Used with switch position T3. Always test operation after adjusting to ensure that the set time allowed is compatible with the functionality required for the turnstile. Refer to the Entry Time Adjusting Control Switch Settings table below. (Default)	T4	T4ON	Adjustment control of the maximum throughput time allowed for an individual to completely travel through the turnstile before the turnstile automatically relocks. Used with switch position T3. Always test operation after adjusting to ensure that the set time allowed is compatible with the functionality required for the turnstile. Refer to the Entry Time Adjusting Control Switch Settings table below.

NOTE: In order to control a Clockwise Lock Arm, the solenoid leads MUST be connected to the Clockwise board inputs. Likewise, in order to control a Counter Clockwise Lock Arm, then the solenoid leads MUST be connected to the Counter Clockwise board inputs.

<i>Explanation of switch positioned to left or OFF side</i>	<i>Switch Position</i>	<i>Switch Position</i>	<i>Explanation of switch positioned to right or ON side</i>
Sets Length of time of contact closure on CNT and COM feedback to 100ms. (Default)	100	FBPL	Sets Length of time of contact closure on CNT and COM feedback to 300ms.
Sets operation for when a JS3 yellow / green / red light board is used. The yellow light is lit when the turnstile is powered and ready for card presentation. When a contact is provided to "Entry Accept" (Location ACC), the green light illuminates. The green light stays on for a user definable time, or until the turnstile is rotated (See the explanation provided for Switch SW4). When a contact is provided to "Entry Reject" (Location REJ), a Red light illuminates. The red light illuminates for 3 seconds. Requires light board connection to J9 and/or J10.	JS3	JS2	Sets operation for when a JS2 red / green light board is used. The red light will be lit when the turnstile is powered and ready for card presentation. When a contact is provided to "Entry Accept" (Location ACC), the green light illuminates. The green light stays on for 20 seconds, or until the turnstile is rotated. Requires light board connection to J9 and/or J10. (Default)
Sets operation to standard optical sensor configuration for passage feedback after second sensor detection. (Default)	STD	ROFP	Sets operation to custom optical sensor configuration for passage feedback on first sensor detection.
Not used (Default)	AUX	AUX	Not used

TIMED DELAY RESET TIMER (Positions T3 and T4)

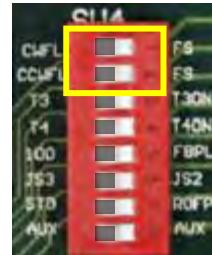
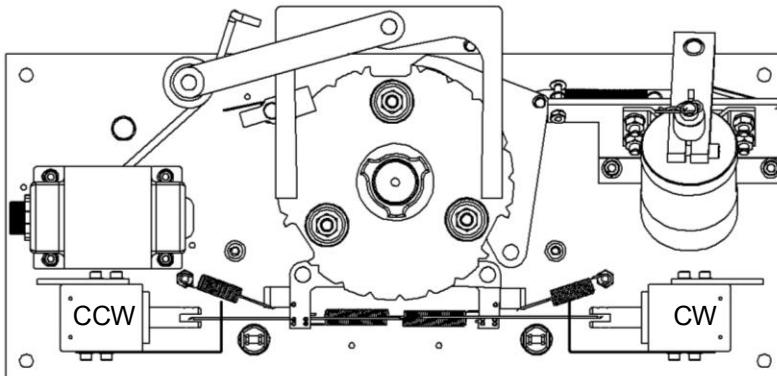
Switch **Setting**

5 seconds	T3	ON
	T4	ON
10 seconds	T3	ON
	T4	OFF
15 seconds	T3	OFF
	T4	ON
20 seconds (Default Setting)	T3	OFF
	T4	OFF

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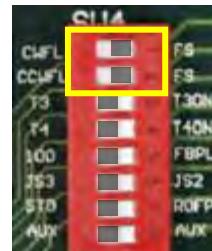
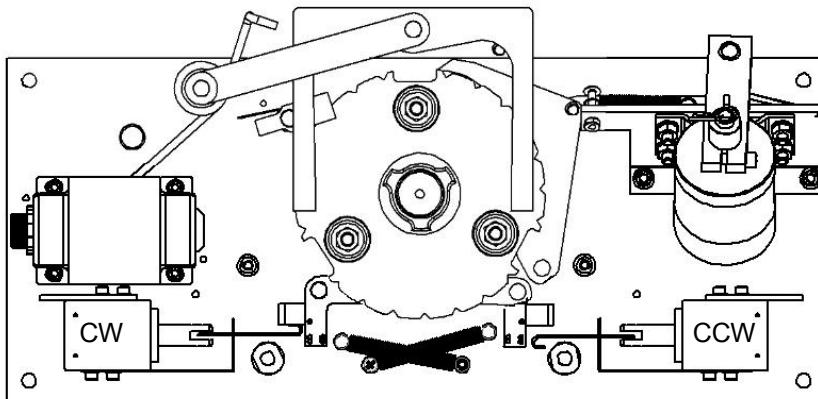
Fail Safe Configuration



- The dipswitches on the ATC controller board are turned to “Fail Safe”
- The solenoid springs are configured per the above figure.
- Each solenoid is wired to its corresponding input on the ATC board.



Fail Lock Configuration



- The dipswitches on the ATC controller board are turned to “Fail Lock”
- The solenoid springs are configured per the above figure.
- Each solenoid is wired to its corresponding input on the ATC board.



Reference Alvarado Field Service Document 3293 for converting from Fail Safe to Fail Lock

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MAINTENANCE

Inspect the installed turnstiles approximately 60 days after the initial installation. Thereafter, the frequency of maintenance will depend on usage and the environment. We suggest inspecting and lubricating the turnstile interior approximately twice a year. Interior maintenance should be performed more frequently in high use applications and/or in dusty or humid environments. Periodically check the anchor bolts for tightness. Exterior cleaning should be performed as necessary.

INTERIOR CARE:

- General** – Remove the turnstile lid and check the tension of the two anchoring shafts. Tighten to approximately 80 ft-lbs. Check tension of all nuts, bolts and screws. Clean away accumulated dust and dirt.
- Optical Sensors** – Manually rotate the turnstile and inspect the alignment of the optical sensors. The sensor feedback disk should rotate freely between the sensors. Tighten the sensor mounting screws if necessary.
- Wiring** – Inspect all wires and contacts for exposure to any metal parts that may lead to a short.
- Movement** – Verify that the compression arm and shoe move freely. If the movement is not smooth, remove both parts and apply 3-in-1 oil. Replace parts and check movement.
- Hydraulic Cylinder** – Verify that the hydraulic cylinder is properly adjusted by observing the rotation of the turnstile arms. If the turnstile is electrically controlled, first disengage the lock arm in the electrically controlled direction(s).

Spin the arm once rapidly in the testing direction. The turnstile arm should rotate once and stop in the standard position. If the turnstile over rotates, increase the hydraulic tension. Do this by removing the cotter type pin at the top of the hydraulic closure. Tighten the adjusting screw (clock-wise) with a slotted screwdriver. Put the pin back in and retest. Test in increments of 1/8 of a turn.

If the turnstile under-rotates (returns to standard position very slowly), decrease the hydraulic tension. Follow directions as above, but loosen the adjusting screw (turn the adjustment screw counter-clockwise). Replace the pin and retest.

The hydraulic cylinder is adjusted at the factory to a level suitable for most standard applications; however, the viscosity of the hydraulic fluid is affected by extreme variations in temperature. Adjustments may be necessary depending on the application or environmental factors. When making adjustments, ensure that the hydraulic is not adjusted so loosely that the turnstile arm hits the user in the back/rear as they pass through the turnstile.

MAINTENANCE continued...

6. **Lubrication** – Apply a light grade lubricant (i.e. Tri-Flow or 3-in-1 oil with a tube extension applicator) to all contact points. Contact points include spring contact points. Review the graphic on Page 30 for identification of lubrication areas.
7. **Springs** – Inspect the springs for unusual wear and replace if worn or damaged. When replacing springs use only Alvarado supplied parts.
8. **Solenoid** - Do not oil the solenoid plunger. The solenoid plunger is designed to have a “dry” fit.
9. **Wiring** – Inspect all wires and contacts for exposure to any metal parts that may lead to a short.

EXTERIOR CARE:

1. **Stainless Steel** - Stainless steel surfaces include the turnstile arms and lid and, depending on the finish ordered, the cabinet. Stainless steel surfaces may be cleaned using any commercially available polish or cleaner. If a heavier scratch or mark is apparent, a metal blend and finish pad (3M or equivalent) may be used. A quality automotive wax may be used to buff the cabinet after cleaning.
2. **Aluminum Head** - The conical shaped aluminum head can be cleaned using a soft damp cloth.
3. **Powdercoat Finishes** – Powdercoat finishes should be cleaned using a soft damp cloth. Any deep scratches or chips in this type of finish should be touched up to prevent a rust spot from forming. If left untreated, rust will spread. Touch up paint is available from Alvarado.

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TROUBLESHOOTING – EDC

ITEMS TO CHECK FIRST:

- Always check for and remove any debris in or around the solenoid plunger (do not, however, lubricate the solenoid plunger. It is designed to operate “dry”).
- Always check the wiring of the turnstile for any loose or bad connections. Be sure to use the wiring diagram that corresponds to the turnstile model installed.
- **REMINDER NOTE:** You can always test the functionality of the turnstile by pressing the Entry Activation Test Button(s) on the controller board.

Symptom	Possible Cause	Solution
Turnstile does not unlock	The turnstile is not powered (Fail lock units only)	<ul style="list-style-type: none"> ▪ <i>Confirm that the ON/OFF switch is in the ON position.</i> ▪ <i>Confirm that the fuse is still good. If necessary replace the fuse.</i> ▪ <i>Confirm that the LED on the controller board is on and not flickering. If the LED on the controller board is not lit, verify that proper voltage (110 -120VAC) is being provided to the Outlet Box inside the turnstile. Do this by plugging in any device such as a light, drill, radio, etc.</i> ▪ <i>If the proper voltage (110-120VAC) is being provided to the outlet box, verify that the controller board is receiving approximately 10 VAC from the transformer.</i>
	The turnstile is not receiving an activation signal from the Access Control System.	<ul style="list-style-type: none"> ▪ <i>Ensure that the access control system is properly connected to the Entry Accept terminal(s) on the controller board.</i> ▪ <i>Confirm that the access control system is providing a proper activation signal.</i>
	A lock arm spring is missing, broken or worn out.	<ul style="list-style-type: none"> ▪ <i>Replace the springs.</i> NOTE: <i>The springs installed in the EDC turnstile are specifically designed for use in this application. Use only springs purchased from Alvarado Manufacturing. Turnstile springs are not interchangeable and should only be used in their designated locations.</i>
	The lock arm is sticking or binding in the locked position	<ul style="list-style-type: none"> ▪ <i>Clean and lubricate the lock arms.</i> ▪ <i>If necessary adjust the hydraulic dampening unit as described in item #5 of the Maintenance section on Page 19.</i>
	The solenoid is defective.	<ul style="list-style-type: none"> ▪ <i>Test and replace the solenoid as necessary</i>
	The solenoid is de-energizing but the plunger is not “firing”.	<ul style="list-style-type: none"> ▪ <i>Adjust the solenoid plunger-limiting Bracket. See Note #2 on page 23.</i>

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TROUBLESHOOTING – EDC continued...

Symptom	Possible Cause	Solution
Turnstile does not relock	The turnstile is not powered (Fail safe units only)	<ul style="list-style-type: none"> ▪ Confirm that the ON/OFF switch is in the ON position. ▪ Confirm that the fuse is still good. If necessary replace the fuse. ▪ Confirm that the LED on the controller board is on and/or flickering. If the LED on the controller board is not lit, verify that proper voltage (110-120VAC) is being provided to the Outlet Box inside the turnstile. Do this by plugging in any device such as a light, drill, radio, etc. ▪ If the proper voltage (110-120VAC) is being provided to the outlet box, verify that the controller board is receiving approximately 10 VAC from the transformer.
	The optical sensors are obstructed or misaligned.	<ul style="list-style-type: none"> ▪ Remove any dirt or debris that may be obstructing the optical sensors. ▪ If necessary tighten the optical sensor mounting screws so that the turnstile rotation tabs on the optical feedback disk pass through the sensors clearly.
	The optical feedback disk is damaged or broken	<ul style="list-style-type: none"> ▪ Repair or replace the feedback disk
	A lock arm spring is missing, broken or worn out.	<ul style="list-style-type: none"> ▪ Replace the springs. <p style="margin-left: 20px;">NOTE: The springs installed in the EDC turnstile are specifically designed for use in this application. Use only springs purchased from Alvarado Manufacturing. Turnstile springs are not interchangeable and should only be used in their designated locations.</p>
	The lock arm is sticking or binding in the unlocked position	<ul style="list-style-type: none"> ▪ Clean and lubricate the lock arms. ▪ If necessary adjust the hydraulic dampening unit as described in item #5 of the Maintenance section on Page 19.
	The solenoid is defective.	<ul style="list-style-type: none"> ▪ Test and replace the solenoid as necessary
	The solenoid is energizing but the plunger is not “firing”.	<ul style="list-style-type: none"> ▪ Adjust the solenoid plunger-limiting Bracket. See Note #2 on page 23.

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TROUBLESHOOTING – EDC continued...

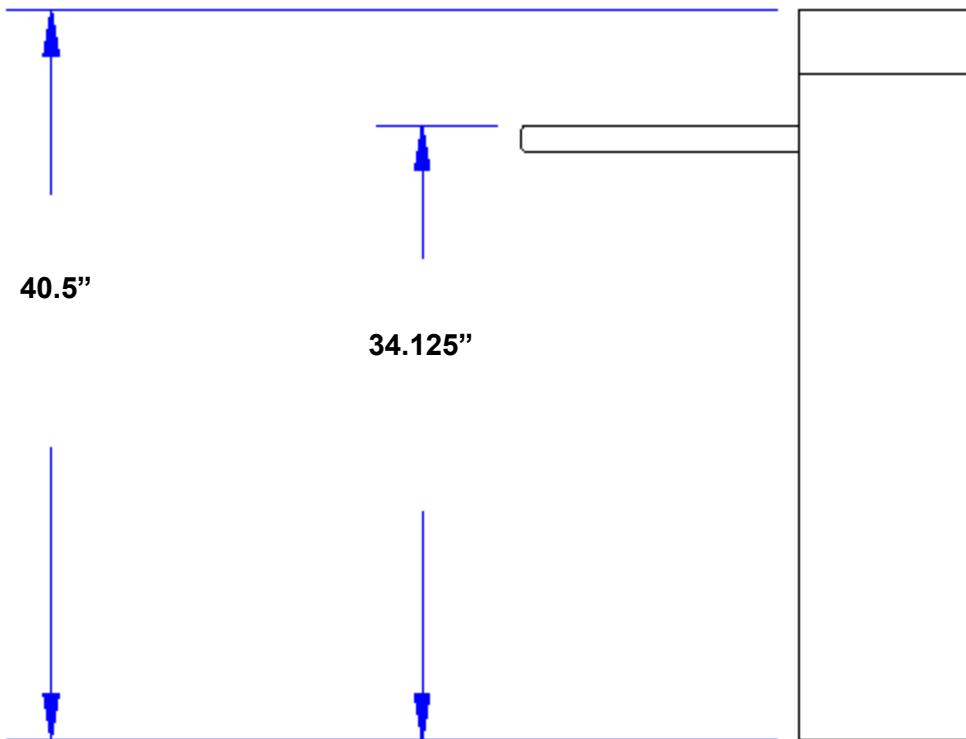
Symptom	Possible Cause	Solution
The turnstile does not automatically relock if an entrance does not occur	The duration of the timed delay automatic relock feature is too long.	▪ Decrease the time duration with the dip switch settings as described on Page 17 before the unit “times out”. The dip switch settings that control the timed delay are on terminals T3 and T4 on SW4 (see page 17).
The turnstile automatically relocks before the user can pass through the turnstile	The duration of the timed delay automatic relock feature is too short.	▪ Increase the time duration with the dip switch settings as described on Page 17 before the unit “times out”. The dip switch settings that control the timed delay are on terminals T3 and T4 on SW4 (see page 17).
The turnstile head does not turn smoothly	The turnstile is not properly lubricated.	▪ Clean and lubricate the pivot points as described in the Maintenance section of this document. ▪ If necessary adjust the hydraulic dampening unit as described in item #5 of the Maintenance section on Page 19.
The solenoid plunger is sticking.	The solenoid is obstructed by foreign matter or debris.	▪ Remove any dirt or debris that may be obstructing the solenoid or the plunger.
	The solenoid bracket is out of alignment.	▪ Adjust the solenoid plunger-limiting Bracket.

NOTES:

1. The EDCX turnstile is designed to receive a momentary dry contact closure. The duration of the contact must be 25 ms or greater.
2. Maintain a spacing of 1.75" from the face of the solenoid to the face of the bracket. Bend the bracket back towards or away from the solenoid to adjust. Check the 1.75" measurement with both the plunger pulled in and with the plunger in the release position.

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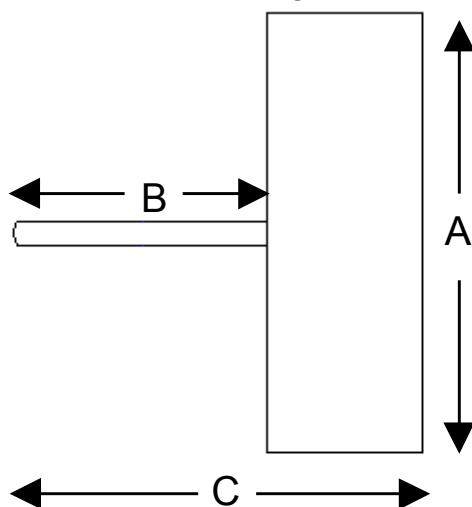
EDC PLAN & ELEVATION VIEW DRAWINGS



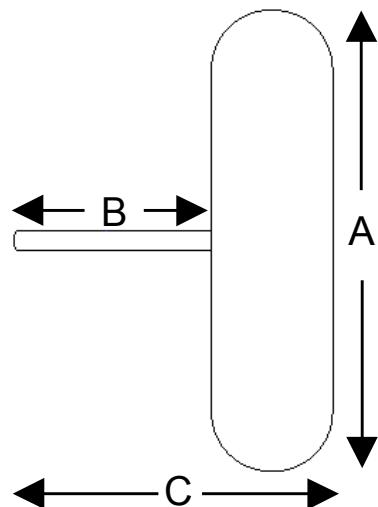
DIMENSIONS:

Model	A	B	C
EDC	27.0"	15.5"	25.0"
EDC Extended	34.0"	20.5"	30.0"
EDC Bullnose	36.5"	15.5"	25.0"
EDC Ext. Bullnose	43.5"	20.5"	30.0"

**STANDARD / EXTENDED EDC
CABINET – TOP VIEW**



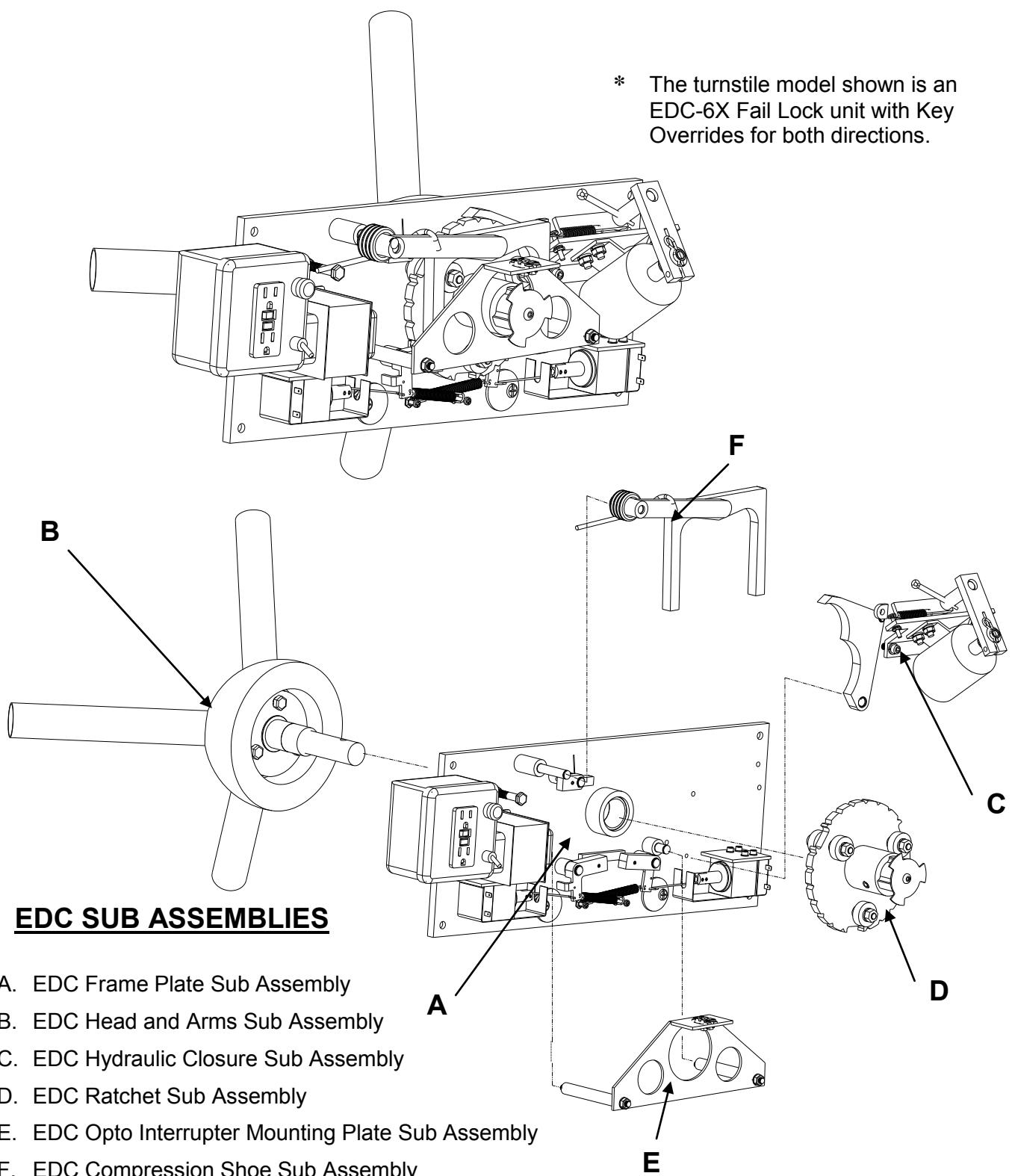
**BULLNOSE / EXTENDED BULLNOSE
EDC CABINET – TOP VIEW**



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EDC EXPLODED PARTS DETAIL*

* The turnstile model shown is an EDC-6X Fail Lock unit with Key Overrides for both directions.

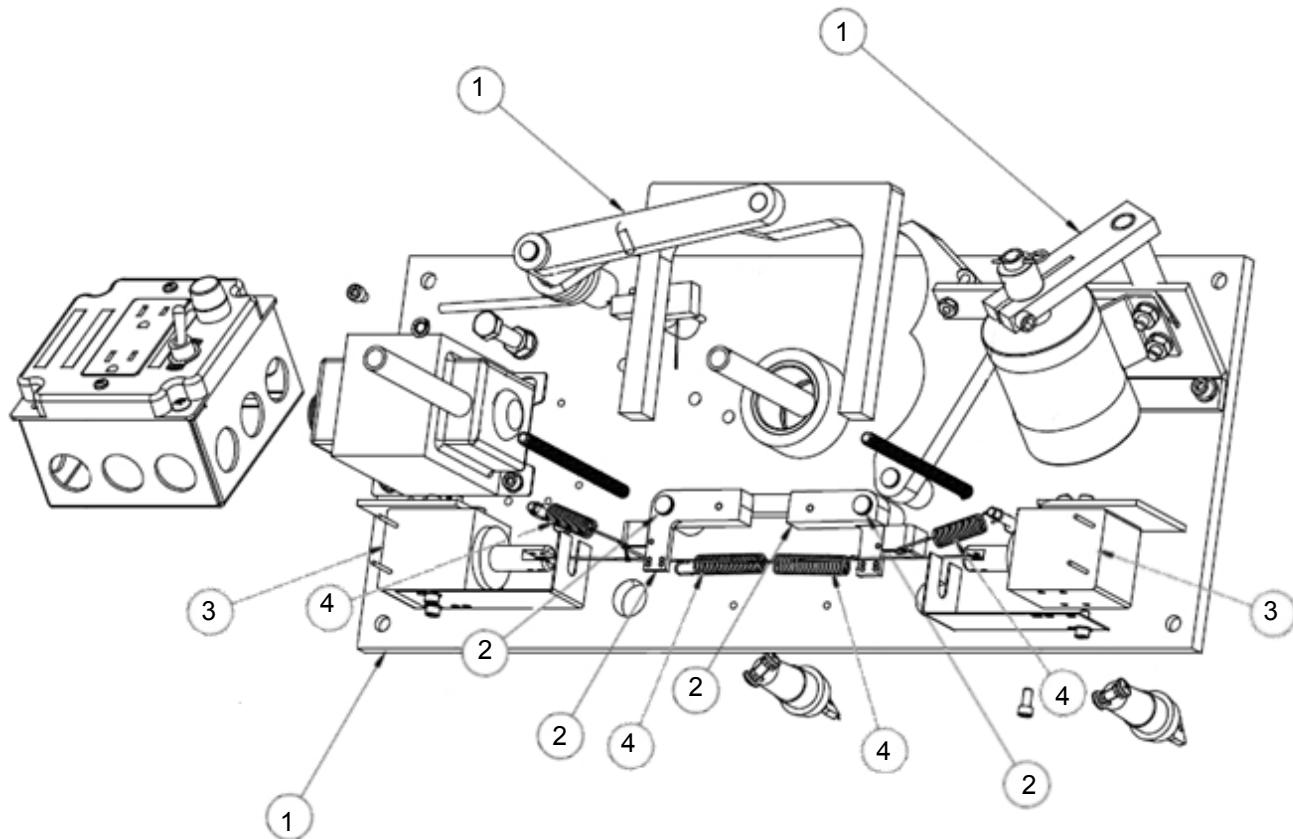


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EDC EXPLODED PARTS DETAIL continued...

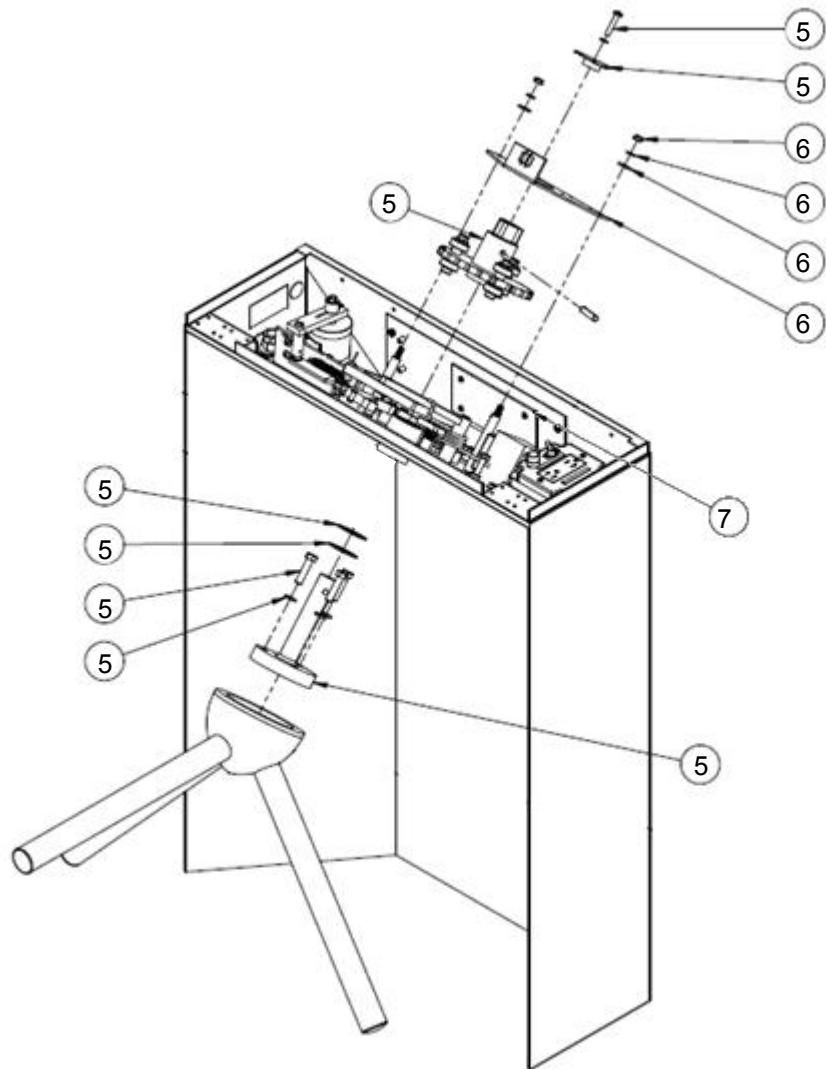


ITEM	KIT PART NUMBER	DESCRIPTION	QTY.
1	50-04-7130	EDC, BASIC, MECH., FRAME KIT	1
2	50-EDC-LK	EDC/EDCX/SLT LOCK ARM KIT	1
3	50-10-1070	SOLENOID (12VDC) KIT	1
4	50-EDC-S1	EDC SPRING KIT	1

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EDC EXPLODED PARTS DETAIL continued...

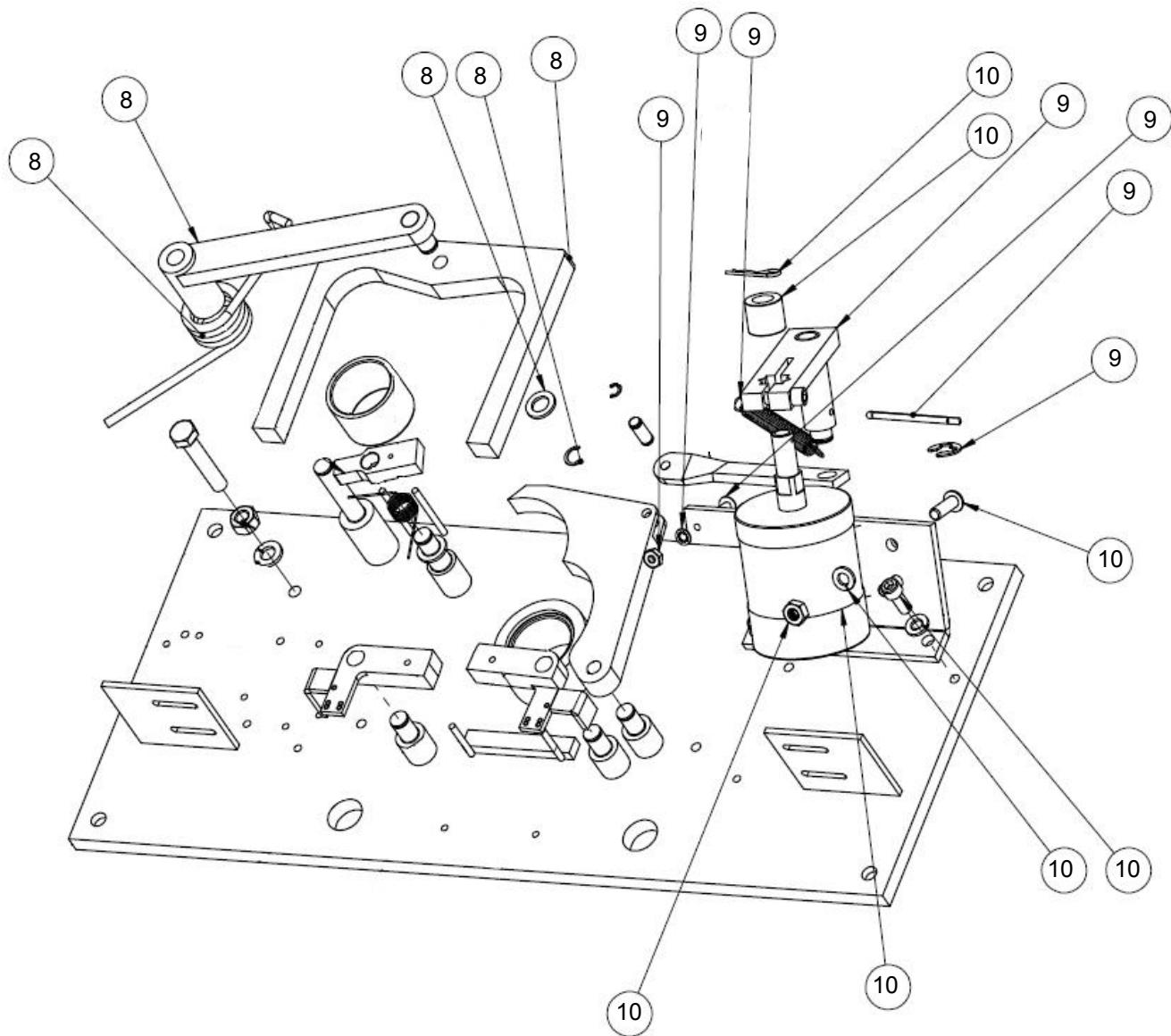


ITEM	KIT PART NUMBER	DESCRIPTION	QTY.
5	50-04-7141	EDC,RATCHET & MAIN SHAFT KIT	1
6	50-04-7380A	EDCX OPTICAL SENSOR ASSY KIT	1
7	50-10-7821	MSTX/EDCX ATC BOARD KIT	1

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EDC EXPLODED PARTS DETAIL continued...



ITEM	KIT PART NUMBER	DESCRIPTION	QTY.
8	50-04-7241	EDC, SHOE, COMPRESSION, KIT	1
9	50-04-7280	EDC, ARM ASSY, DECELERATION, KIT	1
10	50-11-9060	EDC HYDRAULIC CLOSURE KIT	1

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EDC EXPLODED VIEW PARTS LISTING*

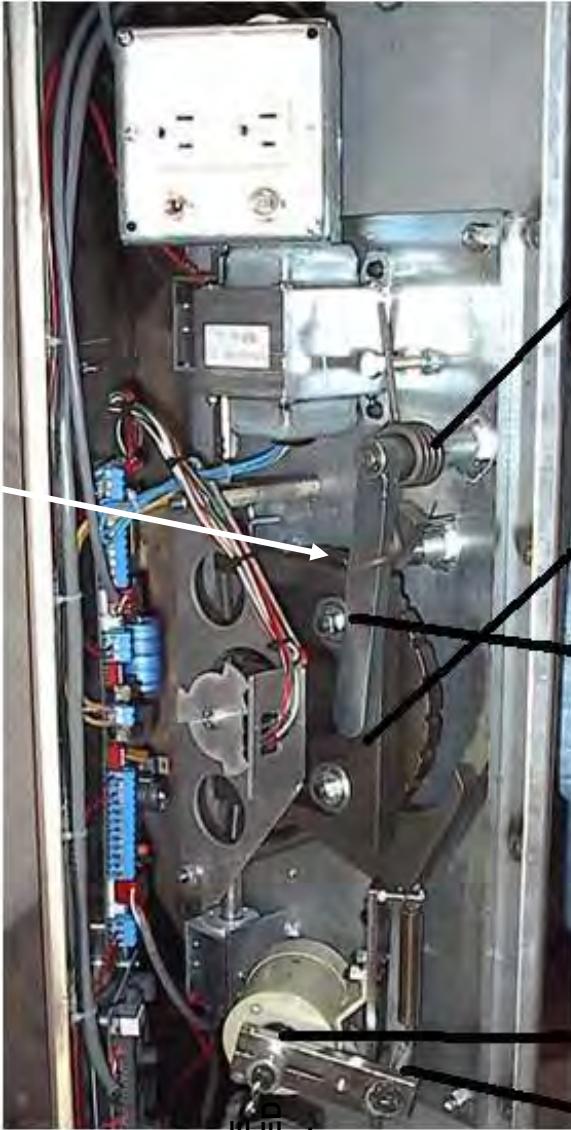
ITEM	KIT PART NUMBER	DESCRIPTION	QTY.	QTY. PER KIT
1	50-04-7130	EDC, BASIC, MECH, FRAME KIT	1	
		EDC,BASIC,MECH.,FRM,ASSY		1
		5/16-18 LOCK NUT - ZINC		4
		1/4 CRESENT RETAINING RING		2
		3/8 CRESENT RETAINING RING		10
		EDC,BASIC,MECH.,FRM,ASSY		1
2	50-EDC-LK	EDC/EDCX/SLT LOCK ARM KIT	1	
		EDC,LOCK ARM,KO,LEFT HAND		1
		EDC,LOCK ARM,KO,RIGHT HAND		1
		3/8 CRESENT RETAINING RING		4
		1/8 X 1 ROLL PIN-BLACK OXIDE		2
3	50-10-1070	SOLENOID (12 VDC) KIT	1	
		Solenoid (12V DC)		2
		Screw , 8-32 X 3/8 SHCS-BLK OXIDE		8
		Lock-Washer, #8 Internal Tooth -Zinc		8
4	50-EDC-S1	EDCX SPRING KIT	1	
		EDC,SPRING,COMPRESSION ARM		1
		EDC,SPRING,BACK PAWL		1
		EDC,SPRING,SOLENOID,FAILSAFE		2
		EDC,SPRING,RETURN,SOLENOID,FS		2
		EDC,SPRING,LOCK ARM		2
		EDC,SPRING,RETURN,HYD. CLOSURE		1
		EDC,LINK,SOLENOID,FAILLOCK		2
5	50-04-7141	EDC,RATCHET & MAIN SHAFT KIT	1	
		EDC,RATCHET & MAIN SHAFT ASSY		1
		EDC,WHEEL,OPTICAL ENCODER		1
		EDC,FLAT BEARING		2
		1/4-20 X 1-1/4"-PHMS-ZINC		1
		3/8-16 X 1-1/2 HHCS-GRD 5-ZINC		3
		1/4 SPLIT LOCKWASHER-ZINC		1
		3/8 SPLIT LOCKWASHER - ZINC		3
		5/16 X 2 ROLL PIN-BLACK OXIDE		1
		1" ID x 0.032" SHIM -BRASS		1
6	50-04-7380A	EDCX OPTICAL SENSOR ASSY KIT	1	
		EDC,OPTICAL SENSOR ASSY		1
		1/4-20 HEX NUT-ZINC		2
		1/4 FLAT WASHER-ZINC		2
		1/4 SPLIT LOCKWASHER-ZINC		2
7	50-10-7821	ATC DRIVER BOARD KIT	1	
		MSTX / EDCX (ATC) Driver Board		1
		Standoff, 1", 6-32, Male Female		4
8	50-04-7241	EDC,SHOE,COMPRESSION,KIT	1	
		EDC,ARM,COMPRESSION,ZINC PLATE		1
		EDC,SHOE,COMPRESSION,REAMED		1
		EDC,SPRING,COMPRESSION ARM		1
		3/8RM X 5/8OD X 1/16 WASHR-CAD		2
		3/8 CRESENT RETAINING RING		4
9	50-04-7280	EDC,ARM ASSY,DECELERATION,KIT	1	
		EDC,ARM ASSY,DECELERATION		1
		EDC,SPRING,RETURN,HYD. CLOSURE		1
		8-32 X 1"THSMS-ZINC		1
		8-32 HEX NUT-ZINC		1
		#8 INTERNAL TOOTH LCKWSHER-ZINC		1
		7/16 RETAINING RING		2
		1/8 X 2 COTTER PIN		1
10	50-11-9060	EDC HYDRAULIC CLOSURE KIT	1	
		EDC,SPRING,COMPRESSION ARM		1
		EDC HYDRAULIC CLOSURE UNIT		1
		EDC CLOSURE UNIT SPACER		1
		1/4-20 X 5/8 SHCS-BLK OXIDE		2
		1/4-20 X 3/4 BHSCS-BLK OXIDE		4
		1/4-20 HEX NUT-ZINC		4
		1/4 SPLIT LOCKWASHER-ZINC		6

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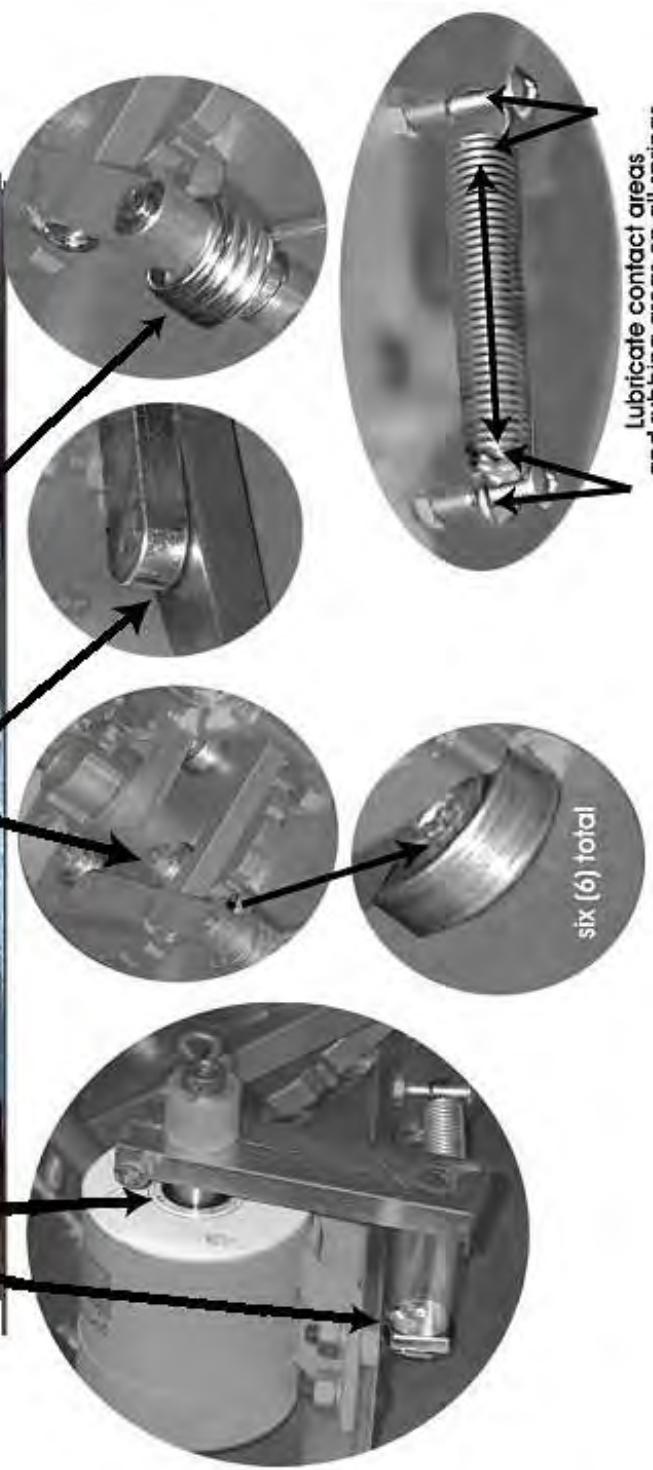
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LUBRICATION GUIDE

ROTATE TURNSTILE ARMS TO LUBRICATE
THESE AREAS.



APPLICATIONS WITH TUBE
EXTENSIONS ARE REQUIRED
TO REACH SOME AREAS.



Lubricate contact areas
and rubbing areas on all springs

LUBRICATE ALL AREAS INDICATED BY BLACK AND WHITE ARROWS.

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